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| 10/091,983                   | 03/06/2002  | Dong Zhong           | CS01-067            | 6380             |
| 28112                        | 7590        | 11/06/2003           | EXAMINER            |                  |
| GEORGE O. SAILE & ASSOCIATES |             |                      | TOLEDO, FERNANDO L  |                  |
| 28 DAVIS AVENUE              |             |                      | ART UNIT            |                  |
| POUGHKEEPSIE, NY 12603       |             |                      | PAPER NUMBER        |                  |

2823

DATE MAILED: 11/06/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/091,983

Applicant(s)

ZHONG ET AL.

Examiner

Fernando Toledo

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 06 March 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 06 March 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1 – 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kraft et al. (U. S. patent 6,136,654).

In re claim 1, Kraft, in the U. S. patent 6,136,654; figures 1 – 8 and related text, discloses on a substrate 12, providing a layer of silicon oxide 14; by means of decoupled plasma nitridation (Column 4, Lines 50 – 55), forming a nitrogen bearing layer 20 that extends downwards a distance from the upper surface; and then annealing the nitrogen bearing layer in a mixture of nitrogen, oxygen at a temperature and a pressure for some time, whereby the nitrogen bearing layer becomes substantially free of structural defects (Column 5, Lines 9 – 17).

Kraft does not disclose that the temperature is between about 1,000 – 1,100<sup>0</sup>C and a pressure between 5 – 15 torr and for about 60 – 150 minutes.

However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to anneal the nitride bearing layer of Kraft at a temperature of between about 1,000 – 1,100<sup>0</sup>C and a pressure between 5 – 15 torr and for about 60 – 150 minutes, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*,

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105 USPQ 233. Note that the specification contains no disclosure of either the critical nature of the claimed temperature ranges, pressure ranges and time ranges or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen temperature ranges, pressure ranges and time ranges or upon another variable recited in a claim, the Applicant must show that the chosen temperature ranges, pressure ranges and time ranges are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990). In addition, the selection of temperature, pressure and time, its obvious because it is a matter of determining optimum process conditions by routine experimentation with a limited number of species of result effective variables. These claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996)(claimed ranges or a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill or art) and *In re Aller*, 105 USPQ 233 (CCPA 1995) (selection of optimum ranges within prior art general conditions is obvious).

3. In re claim 2, Kraft discloses wherein the step of decouples plasma nitridation further includes using RF power at a pressure of  $1-3 \times 10^{-2}$  torr for 10 – 300 seconds.

Kraft does not disclose wherein the RF power is between 250 and 350 watts.

However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use a decoupled plasma nitridation in Kraft of 250 to about 350 watts

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of RF power, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. Note that the specification contains no disclosure of either the critical nature of the claimed RF power ranges or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen RF power ranges or upon another variable recited in a claim, the Applicant must show that the chosen RF power ranges are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990). In addition, the selection of RF power ranges, its obvious because it is a matter of determining optimum process conditions by routine experimentation with a limited number of species of result effective variables. These claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996)(claimed ranges or a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill or art) and *In re Aller*, 105 USPQ 233 (CCPA 1995) (selection of optimum ranges within prior art general conditions is obvious).

4. In re claim 3, Kraft discloses wherein the nitrogen bearing layer is selected from the group consisting of silicon nitride or silicon oxynitride (Column 4, Lines 12 – 29).

5. In re claim 4, Kraft discloses wherein the nitrogen bearing layer contains at least 3 atomic percent nitrogen (Figure 7).

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6. In re claim 5, Kraft discloses wherein the mixture of nitrogen and oxygen contains between about 10 to 30 volume percent oxygen (Column 4, Lines 12 – 29).

7. In re claim 6, Kraft discloses wherein the distance that the nitrogen bearing layer extends downward from the upper surface is between 2 and 10 Å (Figure 7).

8. In re claim 7, Kraft discloses wherein the layer of silicon oxide has a thickness between about 8 and 30 Å (Column 4, Lines 45 – 47).

9. Claims 8 – 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bertrand et al. (U. S. patent 6,632,740 B1) in view of Kraft.

In re claim 8, Bertrand discloses, in the U. S. patent 6,632,740 B1; figures 1(A) – 2(E) and related text, providing a silicon wafer 1, of a first conductivity type, and forming thereon a layer of silicon oxide 4 having an upper surface; depositing a layer of polysilicon 6 on the layer of silicon oxide; patterning and etching the layer of polysilicon and the layer of silicon oxide to form a gate pedestal on a layer of gate oxide (Figure 9); and using the gate pedestal as a mask, forming source and drain (8 and 9) regions of a second conductivity type that immediately abut the gate oxide, thereby forming the field effect transistor and whereby the field effect transistor has an electrical performance as good as a device that is similar in all respects to the field effect transistor except for the absence of the nitrogen bearing layer (Figure 2C).

Bertrand does not disclose, by means of decoupled plasma nitridation, forming a nitrogen bearing layer that extends downwards a distance from the upper surface; then annealing the nitrogen bearing layer in a mixture of nitrogen and oxygen, at a temperature between about 1000

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and 1100 °C and a pressure between 5 and 15 torr, for between about 60 and 150 minutes, whereby the nitrogen bearing layer becomes substantially free of defects.

However, Kraft discloses, by means of decoupled plasma nitridation (Column 4, Lines 50 – 55), forming a nitrogen bearing layer 20 that extends downwards a distance from the upper surface; and then annealing the nitrogen bearing layer in a mixture of nitrogen, oxygen at a temperature and a pressure for some time, whereby the nitrogen bearing layer becomes substantially free of structural defects (Column 5, Lines 9 – 17), since according to Kraft the scaling of the devices in the lateral dimension requires vertical scaling as well so as to achieve adequate device performance. This vertical scaling requires the thickness of the gate dielectric to be reduced so as to provide the required device performance (Column 1, Lines 26 – 31).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to by means of decoupled plasma nitridation, forming a nitrogen bearing layer that extends downwards a distance from the upper surface; and then annealing the nitrogen bearing layer in a mixture of nitrogen, oxygen at a temperature and a pressure for some time, whereby the nitrogen bearing layer becomes substantially free of structural defects in the invention of Bertrand, since, as taught by Kraft, the scaling of the devices in the lateral dimension requires vertical scaling as well so as to achieve adequate device performance. This vertical scaling requires the thickness of the gate dielectric to be reduced so as to provide the required device performance.

Bertrand in view of Kraft does not disclose that the temperature is between about 1,000 – 1,100°C and a pressure between 5 – 15 torr and for about 60 – 150 minutes.

However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to anneal the nitride bearing layer of Bertrand in view of Kraft at a temperature of between about 1,000 – 1,100<sup>0</sup>C and a pressure between 5 – 15 torr and for about 60 – 150 minutes, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. Note that the specification contains no disclosure of either the critical nature of the claimed temperature ranges, pressure ranges and time ranges or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen temperature ranges, pressure ranges and time ranges or upon another variable recited in a claim, the Applicant must show that the chosen temperature ranges, pressure ranges and time ranges are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990). In addition, the selection of temperature, pressure and time, its obvious because it is a matter of determining optimum process conditions by routine experimentation with a limited number of species of result effective variables. These claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996)(claimed ranges or a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill or art) and In re Aller, 105 USPQ 233 (CCPA 1995) (selection of optimum ranges within prior art general conditions is obvious).



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10. In re claim 9, Bertrand in view of Kraft does not disclose wherein the gate pedestal has a width between about 0.05 to 0.25 microns.

However, it would have been obvious to one having ordinary skill in the art at the time the invention was made have a gate pedestal with a width of between 0.05 to 0.25 microns in the invention of Bertrand in view of Kraft, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. Note that the specification contains no disclosure of either the critical nature of the claimed width or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen width or upon another variable recited in a claim, the Applicant must show that the chosen width is critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990). In addition, the selection of width ranges, its obvious because it is a matter of determining optimum process conditions by routine experimentation with a limited number of species of result effective variables. These claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996)(claimed ranges or a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill or art) and *In re Aller*, 105 USPQ 233 (CCPA 1995) (selection of optimum ranges within prior art general conditions is obvious).

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11. In re claim 10, Bertrand in view of Kraft discloses wherein the step of decouples plasma nitridation further includes using RF power at a pressure of  $1-3 \times 10^{-2}$  torr for 10 – 300 seconds.

Bertrand in view of Kraft does not disclose wherein the RF power is between 250 and 350 watts.

However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use a decoupled plasma nitridation in Bertrand in view of Kraft of 250 to about 350 watts of RF power, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. Note that the specification contains no disclosure of either the critical nature of the claimed RF power ranges or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen RF power ranges or upon another variable recited in a claim, the Applicant must show that the chosen RF power ranges are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990). In addition, the selection of RF power ranges, its obvious because it is a matter of determining optimum process conditions by routine experimentation with a limited number of species of result effective variables. These claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996)(claimed ranges or a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily

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within skill or art) and In re Aller, 105 USPQ 233 (CCPA 1995) (selection of optimum ranges within prior art general conditions is obvious).

12. In re claim 11, Bertrand in view of Kraft discloses wherein the nitrogen bearing layer is selected from the group consisting of silicon nitride or silicon oxynitride (Column 4, Lines 12 – 29).

13. In re claim 12, Bertrand in view of Kraft discloses wherein the nitrogen bearing layer contains at least 3 atomic percent nitrogen (Figure 7).

14. In re claim 13, Bertrand in view of Kraft discloses wherein the mixture of nitrogen and oxygen contains between about 10 to 30 volume percent oxygen (Column 4, Lines 12 – 29).

15. In re claim 14, Bertrand in view of Kraft discloses wherein the distance that the nitrogen bearing layer extends downward from the upper surface is between 2 and 10 Å (Figure 7).

16. In re claim 15, Bertrand in view of Kraft discloses wherein the layer of silicon oxide has a thickness between about 8 and 30 Å (Column 4, Lines 45 – 47).

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Fernando Toledo whose telephone number is 703-305-0567. The examiner can normally be reached on Mon-Fri 8am to 4pm.

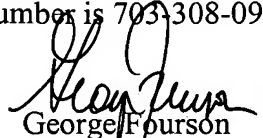
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 703-306-2794. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

  
George Fourson  
Primary Examiner  
Art Unit 2823

  
FToledo